RADIO MODULE

MXR-505

UHF FM TRANSCEIVER MODULE

PRELIMINARY

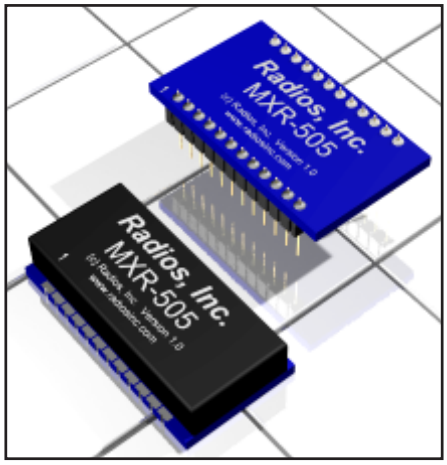
DATA SHEET

Radios, Inc.

May 30, 2007 Preliminary Data Sheet

MXR-505

UHF FM TRANSCEIVER MODULE



The MXR-505 is a frequency shift keyed (FSK) high performance, ultra compact, long range transceiver operating at the 902-928 MHz and 868.25 MHz bands. This integrated modularized transceiver is designed for use in half-duplex, bidirectional RF links. The multi-channeled MXR-505 is intended for use in UHF radio equipment in compliance with both the North American Federal Communications Commission (FCC) part 15.247 and 15.249 systems and the European Telecommunications Standard Institute (ETS) specification EN300 200.

The transmitter is composed of both a PLL frequency synthesizer and a power amplifier. The synthesizer uses a voltage-controlled crystal oscillator, a dual-modulus prescaler, programmable frequency dividers, and a phase-detector. The power amplifier's output power can be programmed to seven different levels.

The MXR-505 has zero IF architecture which enables channel filtering with low-power, integrated low-pass filters. Each channel includes a pre-amplifier and a third order Sallen-Key RC low-pass filter that protects the switched-capacitor filter from strong adjacent channel signals. The main channel filter is a switched-capacitor implementation of a six-pole elliptic low pass filter. The cutoff frequency of the Sallen-Key RC filter can be programmed to four different frequencies: 100kHz, 150 kHz, 230 kHz, and 340 kHz. A receive signal strength indicator circuit indicates the received signal level. The MXR-505 is a well-designed transceiver suitable for a variety of RF applications, particularly voice applications and high volume OEM applications.

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Key Features

- Low cost
- Wide supply voltage range
- Wide operating temperature range
- Easily integrated
- Low power consumption
- Compact surface-mount packages/Small Size
- 2.5V operation
- Simple serial programming interface
- Baud rate from 1200 to 200,000 bps
- Spread spectrum
- External reset pin
- Exceptional sensitivity: -111dBm
- Receive signal stength (RSSI) pin
- No production tuning

Typical Applications

- Remote controls
- Garage openers / Gate controls
- Keyless entry
- Lighting control
- Home / Industrial automation
- Continuous / Periodic data transfer
- Wireless networking
- Remote access
- Remote monitoring / Telemetry
- Medical monitoring / Call systems
- Guard patrol / Lone worker protection
- Domestic / Commercial security
- Fire / Security alarms
- Long-range RFID
- Automated meter reading

Contact Information	
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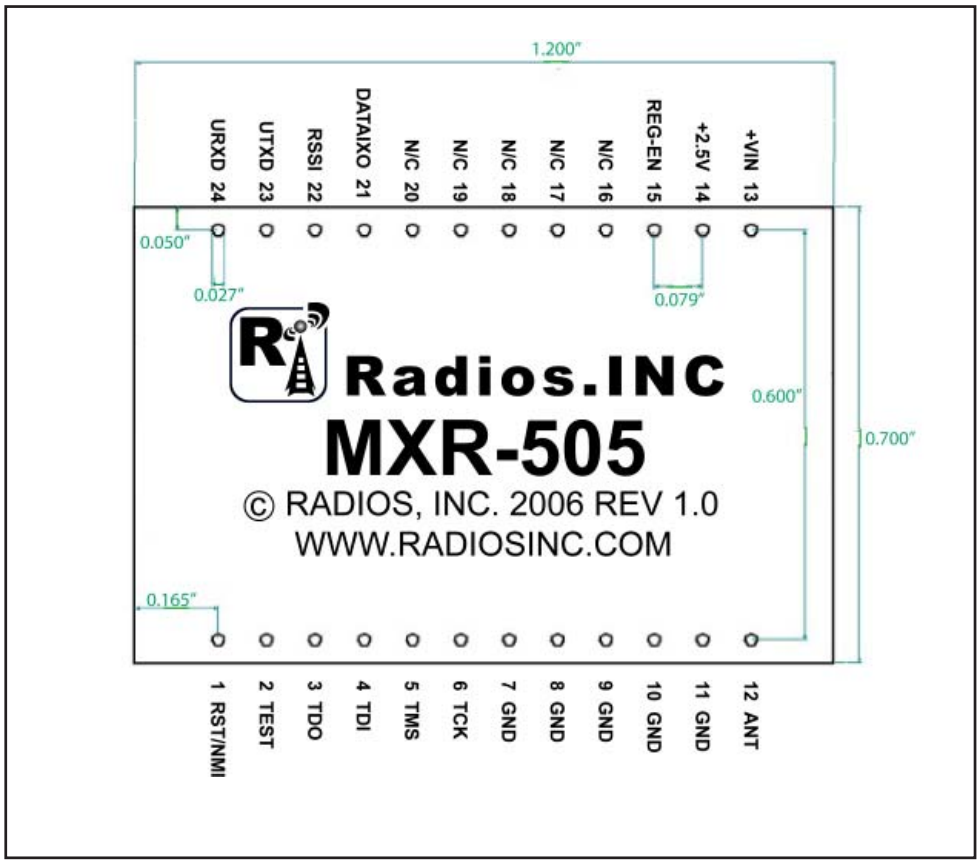
Mechanical and Pin Diagram

* Note: Pinouts of surface mount and through-hole packages are mirrored



DIP Package

Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	RST/NMI	No Connect	Pin 13	+VIN	Positive Supply Pin (2.6-16V)
Pin 2	TEST	No Connect	Pin 14	+2.5V	Regulated Output (2.5V)
Pin 3	TDO	No Connect	Pin 15	REG-EN	Regulator Enable (2-VCC)
Pin 4	TDI	No Connect	Pin 16	N/C	No Connect
Pin 5	TMS	No Connect	Pin 17	N/C	No Connect
Pin 6	TCK	No Connect	Pin 18	N/C	No Connect
Pin 7	Gnd	Ground	Pin 19	N/C	No Connect
Pin 8	Gnd	Ground	Pin 20	DATACLK	Data Clock Output (0-2.5V)
Pin 9	Gnd	Ground	Pin 21	DATAIXO	Data Input/Output (0-2.5V)
Pin 10	Gnd	Ground	Pin 22	RSSI	Receive Signal Strength Indicator (0-2.5V)
Pin 11	Gnd	Ground	Pin 23	UTXD	Transmit Data Out—UART mode (0-2.5V)
Pin 12	Ant	RF Input/Output (50 Ohms)	Pin 24	URXD	Receive Data Out—UART mode (0-2.5V)

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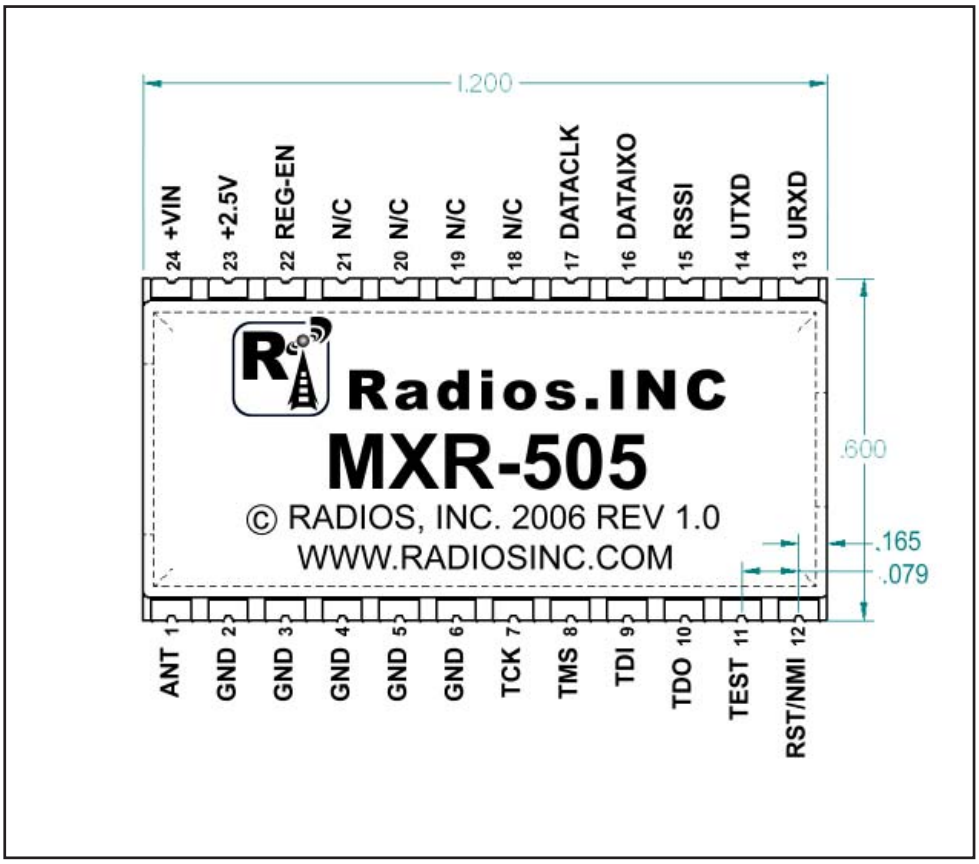
Mechanical and Pin Diagram

* Note: Pinouts of surface mount and through-hole packages are mirrored



Surface Mount Package

Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	Ant	RF Input/Output (50 Ohms)	Pin 13	URXD	Receive Data Out—UART mode (0-2.5V)
Pin 2	Gnd	Ground	Pin 14	UTXD	Transmit Data Out—UART mode (0-2.5V)
Pin 3	Gnd	Ground	Pin 15	RSSI	Receive Signal Strength Indicator (0-2.5V)
Pin 4	Gnd	Ground	Pin 16	DATAIXO	Data Input/Output (0-2.5V)
Pin 5	Gnd	Ground	Pin 17	DATACLK	Data Clock Output (0-2.5V)
Pin 6	Gnd	Ground	Pin 18	N/C	No Connect
Pin 7	TCK	No Connect	Pin 19	N/C	No Connect
Pin 8	TMS	No Connect	Pin 20	N/C	No Connect
Pin 9	TDI	No Connect	Pin 21	N/C	No Connect
Pin 10	TDO	No Connect	Pin 22	REG-EN	Regulator Enable (2-VCC)
Pin 11	TEST	No Connect	Pin 23	+2.5V	Regulated Output (2.5V)
Pin 12	RST/NMI	No Connect	Pin 24	+VIN	Positive Supply Pin (2.6-16V)

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MXR-505 Communication

Communication with the MXR-505 is accomplished through a universal asynchronous receive/ transmit (UART) peripheral interface. The UART uses 8-bit, non-parity, LSB, 1200bps baud format. The maximum number of data bytes that can be transmitted or received in one packet is 50. The user will transmit data through the UART on the MXR-505 via pin 24, URXD. The MXR-505 will packetize and wirelessly transmit the data. Once the data is received on the other side, the MXR-505 will demodulate the data and send the received data out to the user via pin 23, UTXD. The data being sent through the UART should follow a specific protocol.

The communication protocol is outlined below:

Byte #1 **Number of Bytes** – The number of bytes is one byte containing the total number of data bytes. This byte should not be included in the number of bytes. Therefore, the number of bytes should be one less than the total number of bytes being sent or received. The maximum number of data bytes that can be transmitted or received is 50; therefore, the number of bytes should not exceed 50.

Bytes #2-51 **Data Bytes** – The data bytes are the actual data byte values being transmitted or received by the MXR-505. The MXR-505 can send or receive a maximum of 50 data bytes per packet. The first two bytes are used as preamble bytes by Radios, Inc. to differentiate the detection of data from noise. They can be set to any value, but to work with the HHDS-ML they must be set to 0xFF and 0x00, respectively.

When the first byte is received through the UART on the MXR-505, the user will have one second to send the remaining data bytes to the MXR-505. If the MXR-505 does not receive all of the data bytes within that second, the data the MXR-505 did receive will be dumped. For example, if the user sends a 10 for the number of bytes and then only sends five more bytes within one second, the MXR-505 assumes this is corrupted data and does not transmit the packet. The five bytes the MXR-505 did receive will be discarded and the MXR-505 will wait for a new packet of data to be received.

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Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
	Absolute Maximum Ratings					
VCC	Supply Voltage	2.6		16	V	
	Voltage on any Pins	-0.5		2.7	V	
	Storage Temperature Range	0		70	°C	
	Lead Temperature		260		°C	
V_{EN}	Enable Input Voltage	0		16	V	
	ESD Rating				kV	
	Operating Ratings					
	Package Thermal Resistance				°C/W	
V_{EN}	Enable Input Voltage	0		VCC	V	
TA	Ambient operating temperature	0		70	°C	

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Electrical Characteristics

This device is ESD sensitive. Do not operate or store near strong electrostatic fields. Use appropriate ESD precautions. All voltages are with respect to Ground.

Parameters	Test Conditions	Min	Typ	Max	Unit
Power Supply					
RF Frequency Operating Range		2400		2483.5	MHz
Power Supply					V
Power Down Current					µA
Standby current					µA
Quiescent Current		13	20	29	µA
Operating Voltage		2.6		16	V
VCO and PLL Section					
Reference Frequency					MHz
PLL Lock Time 3kHz bandwidth	915MHz to 915.5MHz 902MHz to 927MHz 20kHz bandwidth				ms ms ms
Switch Time 3kHz loop bandwidth	Rx – Tx Tx – Rx Standby Rx Standby Tx				ms ms ms ms
Crystal Oscillator Start-Up Time	16 pF load		0.86		ms
Charge Pump Current	VCPOUT = 1.1V, CP_HI = 0 VCPOUT = 1.1V, CP_HI = 1				µA µA
Charge Pump Tolerance					%
Transmit Section					
Output Power	Delivered to a single ended 50 ohm load through a balun	-3	0		dBm
Output Power Tolerance	Over temperature range Over power supply range				dB dB
Tx Current Consumption	P = -25 dBm P = -15 dBm P = -10 dBm P = -5 dBm P = 0 dBm		8.5 9.9 11 14 17.4		mA mA mA mA mA
Tx Current Consumption Variation	10dBm				mA
Binary FSK Frequency Separation	bitrate = 200kbps				kHz
Data Rate		250		250	kbps
Occupied bandwidth	20kbps, b = 2, 20dBc 125kbps, b = 2, 20dBc 200kbps, b = 2, 20dBc				kHz kHz kHz
2nd Harmonic			-34		dBc
3rd Harmonic			-60		dBc
Spurious Emission	30-1000 MHz 1-12.75 GHz 1.8-1.9 GHz 5.15-5.3 GHz			-36 -30 -47 -47	dBm dBm dBm dBm

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Electrical Characteristics - CONT.

Receive Section					
Rx Current Consumption			19.7		mA
Rx Current Consumption Variation	Over temperature				mA
Receiver Sensitivity		-90	-94		dBm
Receiver Maximum Input Power	125kbps, 125kHz deviation 20kbps, 20kHz deviation				dBm dBm
Receiver Sensitivity Tolerance	Over temperature Over power supply range				dB dB
Receiver Bandwidth					kHz
Co-Channel Rejection					dB
Adjacent Channel Rejection	200kHz spacing 500kHz spacing 1MHz spacing				
Blocking	±1MHz ±2MHz ±5MHz ±10MHz		42 47 38 41		dB dB dB dB
Noise Figure, Cascade			TBD		dB
1dB Compression			-35		dB
Input IP3	2 tones with 1MHz separation		-25		dBm
Input IP2					dBm
LO Leakage				-90	dBm
Spurious Emission	< 1GHz > 1GHz			-54 -54	dBm dBm
Input Impedance			50		Ohms
Input Reflection (s11)			-20	-15	dB
RSSI Dynamic Range			50		dB
RSSI Output Voltage	Pin = 100dBm Pin = 60dBm		0.9 1.85		V V
Digital Inputs/Outputs					
Logic Input High		0.7VCC		VCC	V
Logic Input Low		0		0.3VCC	V
Clock/Data Frequency				10	MHz
Clock/Data Duty Cycle		45		55	%
Regulator Enable Input					
Input Low Voltage	Regulator OFF			0.6	V
Input High Voltage	Regulator ON	2.0			V
Enable Input Current	V_{EN} = 0.6V; Regulator OFF		0.01		µA

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Note 1. Exceeding the absolute maximum rating may damage the device.

Note 2. The device is not guaranteed to function outside its operating rating.

Note 3. Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5k in series with 100pF.

Technical Support:

Radios, Inc. is committed to providing its customers with excellent technical support and the resources necessary to assist them with their product development. All technical support is provided free of charge. Customers have several options to obtain assistance. First, any questions or concerns can be e-mailed to Radios, Inc. at information@radiosinc.com. We monitor our e-mail daily, and will respond to all questions promptly. Additionally, to speak directly to a technical support representative, customers can call Radios, Inc. at 920-564-6622.

Compliance:

Embedded wireless modules are intended for use as component devices which require peripheral elements to operate. Radios, Inc.'s modules are intended to be used in products requiring compliance. They are, however, not pre-approved by the FCC or any other agency worldwide unless so stated. The user or customer understands that regulatory compliance may be required prior to the sale or operation of the module or development system, and agrees to abide by all laws governing the module's or development system's use in the country of operation.

The approval process of embedded wireless modules in the United States is relatively uncomplicated. The Federal Communications Commission (FCC) is the governing body in the US that specifies its requirements in the Code of Federal Regulations (CFR), Title 47. Title 47 consists of several volumes and it is necessary to first identify the correct section that applies to your application. These rules require that a device which intentionally creates RF emissions be FCC compliant; i.e., pre-tested for compliance and assigned an identification number. Radios, Inc. offers pre-screening at one of our affiliate test sites. Final certification is then accomplished by an independent test laboratory. After passing compliance testing, you will be issued a unique ID number which must be placed on each product manufactured.

Any questions dealing with interpretations of the rules relating to testing or compliance should be addressed to:

FCC
Equipment Authorization Division
Customer Service Branch, MN 1300F2
7435 Oakland Mills Road
Columbia, MD 21046

Returns:

Products may be returned directly to Radios, Inc. for evaluation. Returns, without exception, must have a valid RMA number attached. RMA numbers can be obtained by calling a customer service representative at Radios, Inc. If a product is found to be defective and is returned within 90 days of purchase, Radios, Inc. may repair or replace, at its option, said defective product. The warranty does not apply to any products which have been disassembled, modified or subjected to conditions exceeding the application specifications. Under no circumstances will Radios, Inc. be responsible for losses, financial or other, arising from the use or failure of a device in an application or for losses arising from failure to meet delivery requirements, other than the repair, replacement, or refund limited to the original product purchase price. No other warranties, express, implied, or statutory, including warranty of fitness for a particular purpose, apply.

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Editorial Information:

	(Date)
Last Updated	May 30, 2007 PRELIMINARY

Product Ordering Information:

MXR-505 E - 915 D 4800 R A -B

Packaging:	B - Bulk TB - Tube TR - Tape and Reel
Antenna:	A - Antenna - No Antenna
Voltage Regulation:	R - Regulated - Not Regulated
Baud Rate:	600 = 600 bps = 1200 bps 2400 = 2400 bps 4800 = 4800 bps 9600 = 9600 bps 14400 = 14,400 bps 28800 = 28,800 bps 57600 = 57,600 bps
Footprint:	D - Through-hole DS - Through-hole Shielded S - Surface Mount SS - Surface Mount Shielded
Frequency: (based on module's frequency range)	915 = 915 MHz XXX = Custom Frequency
Protocol:	E - Eval * RI - RINet

* Eval software for use with HHDS-ML M only. Will not work for other applications.